CLAIMS

What is claimed is:

1. A method of estimating propagation channels between two or more transmitters and a fewer number of receivers, the method comprising:

transmitting information signals for said receivers jointly from said two or more transmitters, said information signals pre-filtered based on propagation channel estimates;

transmitting at least one dummy pilot signal jointly from said transmitters, said at least one dummy pilot signal pre-filtered based on said propagation channel estimates; and

receiving loop back signals from said receivers having dummy pilot signal interference that is dependent on the accuracy of said propagation channel estimates; and

revising said propagation channel estimates based on said loop back signals.

2. The method of claim 1 wherein revising said propagation channel estimates based on said loop back signals comprises:

correlating said loop back signals with said information signals to determine an amount of dummy pilot signal interference; and

adjusting said propagation channel estimates to reduce said dummy pilot signal interference in said loop back signals.

3. The method of claim 1 wherein said propagation channel estimates comprise propagation channel estimate vectors relating each said receiver to said transmitters, and further comprising determining a supplemental channel estimate vector for each one

of said at least one dummy pilot signal, such that said supplemental channel estimate vectors are orthogonal to said channel estimate vectors.

4. The method of claim 3 wherein pre-filtering said at least one dummy pilot signal based on said propagation channel estimates comprises pre-filtering said at least one dummy pilot signal using said supplemental channel estimate vector.

5. The method of claim 1 wherein transmitting information signals for said receivers jointly from said transmitters comprises transmitting an information signal for one receiver jointly from two transmitters.

6. The method of claim 5 wherein transmitting an information signal for one receiver jointly from two transmitters comprises transmitting the information signal on two transmit polarizations, wherein each said polarization propagates through a different propagation channel to said receiver.

7. The method of claim 1 wherein transmitting information signals for said receivers jointly from said transmitters comprises transmitting a combination of information signals for a first plurality of receivers from each one in a larger plurality of transmitters.

8. The method of claim 7 wherein said transmitters are radio base stations, and wherein comprises pre-filtering said information signals to form a combined transmit signal for each one of said transmitters, said combined transmit signals representing differently weighted combinations of said information signals based on said pre-filtering using said propagation channel estimates.

9. The method of claim 8 further comprising pre-filtering said at least one dummy pilot signal, such that said combined transmit signals further comprise a weighted version of said at least one dummy pilot signal.

10. A method of facilitating estimation of propagation channels between a first number of transmitters and a lesser number of receivers, the method comprising:

transmitting information signals for said receivers jointly from said transmitters based on propagation channel estimates, such that interference between information signals is reduced at each said receiver; and

transmitting a number of dummy pilot signals equal to a difference between the number of transmitters and receivers, such that said dummy pilot signals cause substantially no interference in reception of said information signals by said receivers when said propagation channel estimates substantially match said propagation channels.

11. The method of claim 10 further comprising, for each said dummy pilot signal transmitted, calculating propagation channel estimates for a virtual receiver location corresponding to said dummy pilot signal.

12. The method of claim 10 further comprising choosing said virtual receiver location to be a location relative to said transmitters such that reception of said dummy pilot signal jointly transmitted by said transmitters would be strongest.

13. The method of claim 12 wherein propagation channel estimates for each said receiver relative to said transmitters comprise a channel estimate vector, and wherein choosing a virtual receiver location comprises determining a supplemental channel estimate vector orthogonal to said channel estimate vectors of said receivers.

14. The method of claim 10 further comprising forming said propagation channel estimates into a channel estimate matrix comprising a matrix column for each said transmitter and a matrix row for each said receiver, such that a matrix element represents propagation channel estimates between a given transmitter and a given receiver, and wherein each said matrix row comprises a channel estimate vector.

15. The method of claim 14 further comprising making said channel estimate matrix square for use in pre-filtering said information signals and said dummy pilot signals before transmission by supplementing said channel estimate matrix based on adding supplemental channel estimate vectors as additional matrix rows, wherein each supplemental channel estimate vector corresponds to one of said dummy pilot signals being transmitted by said transmitters.

16. The method of claim 15 further comprising computing said supplemental matrix rows to be orthogonal to said channel estimate vectors for said receivers.

17. The method of claim 15 wherein transmitting information signals for said receivers jointly from said transmitters based on propagation channel estimates comprises pre-filtering said information signals based on said channel estimate matrix such that each transmitter transmits a weighted combination of said information signals, and wherein said weighted combinations of said information signals combine at each said receiver to substantially cancel the information signals for the other receivers.

18. The method of claim 17 wherein transmitting a number of dummy pilot signals equal to a difference between the number of transmitters and receivers comprises pre-filtering said dummy pilot signals based on said channel estimate matrix, such that said

dummy pilot signals substantially cancel at each said receiver, and wherein an amount of interference caused by said dummy pilot signals at each said receiver is a function of mismatch between said propagation channel estimates for that receiver and the actual propagation channels to that receiver.

19. The method of claim 18 further comprising:

determining dummy pilot signal interference at said receivers; and

adjusting said propagation channel estimates based on said determined dummy pilot signal interference.

20. A method of estimating propagation channels between a number transmitters and a lesser number of receivers, the method comprising:

initializing a set of propagation channel estimates for said propagation channels;

generating a number of dummy pilot signals equal in number to a difference between said number of transmitters and receivers;

determining supplemental propagation channel coefficients for each said dummy pilot signal based on said propagation channel estimates intended to cause said dummy pilot signals to substantially cancel at each said receiver, thus causing no interference at said receivers;

pre-filtering said dummy pilot signals and an information signal for each said receiver using said propagation channel estimates and said supplemental propagation channel estimates;

transmitting said information signals and said dummy pilot signals jointly from said transmitters to said receivers after said pre-filtering; and

adjusting said propagation channel estimates based on observed dummy pilot signal interference at said receivers.

21. A wireless communication network comprising:

a transmit processor operative to form a number of transmit signals as weighted combinations of at least one individual information signals and at least one dummy signal by pre-filtering the information signals and the at least one dummy signal using propagation channel estimates;

a number of transmitters operative to transmit said transmit signals;

a loop back signal processor operative to determine interference at one or more wireless receivers receiving said transmit signals caused by transmission of said at least one dummy signal based on receiving loop back signals from the one or more wireless receivers;

wherein said transmit processor adjusts said propagation channel estimates to reduce interference caused by transmitting said at least one dummy signal based on said determined interference.

22. The wireless communication network of claim 21 wherein said transmitters comprise a number of antenna elements on a transmitting antenna, at least one of said antenna elements having a different polarization than another antenna element.

23. The wireless communication network of claim 21 wherein said transmitters comprise a number of radio base stations.

24. The wireless communication network of claim 21 wherein said transmit processor is further operative to form a channel estimate matrix comprising the propagation channel estimates.

25. The wireless communication network of claim 24 wherein said transmit processor is further operative to form said channel estimate matrix as a channel estimate vector for each of the at least one information signals, and a channel estimate vector for each one of the at least dummy signal, wherein the channel estimate vectors for the information signals characterize actual propagation channels from each transmitter to a wireless receiver for which the information signal is intended.

26. The wireless communication network of claim 25 wherein the transmit processor is further operative to form the channel estimate vectors for the at least one dummy signal orthogonal to the channel estimate vectors for the one or more information signals, such that if the channel estimate vectors for the information signals substantially match the actual propagation channels, the at least one dummy signal will cancel at each wireless receiver receiving the transmit signals.

27. The wireless communication network of claim 21 wherein said transmit processor comprises one or more signal processors operative to perform said pre-filtering.

28. The wireless communication network of claim 21 wherein said loop back processor comprises one or more signal processor operative to determine said interference at said receivers by correlating said loop back signals with said dummy signals and said information signals.

29. A wireless network processing system in a wireless communication network wherein a number of transmitters jointly transmit to a lesser number of receivers, the wireless network processing system comprising:

a loop back signal processor to determine interference in a loop back signal from a wireless receiver caused by a dummy pilot signal being transmitted by said transmitters; and

a transmit processor to adjust a transmit pre-filter being applied by said transmit processor to an information signal for the wireless receiver, and being applied to said dummy pilot signal, based on said determined interference;

wherein said loop back signal processor and said transmit processor cooperate to make propagation channel estimates on which said transmit pre-filter is based substantially match actual propagation channel characteristics between said transmitters and the wireless receiver by adjusting said propagation channel estimates to reduce said determined interference.